

*A Q.A.J. special feature . . .*

# **Permanent Electric Fencing For Cattle And Sheep**

*by K. F. HOWARD, Beef Cattle Husbandry Branch,  
Toowoomba*

**The high cost of renewing fencing is one that continually faces the grazer. This feature examines a new concept in fencing—a concept that can save money.**

## Beating fencing costs

1. A property may have to renew say 20 kilometres of fence over the next 20 years. At the present price of \$400 per kilometre for suspension fence, this would mean a total cost of \$8 000 on today's prices for labour and materials. By upgrading say 15 kilometres at present with offset wires for an average of \$80 per kilometre and by building 5 kilometres of new fence for \$150 per kilometre, the total fence cost would be \$1 950 or less than a quarter the cost of suspension fencing. This type of difference in fencing costs can be expected to induce many producers to electrify some or all of their fences over the next few years.

## A different concept

2. Cattle see fences as both obstructions to their course and as conveniences on which to rub themselves. However, once having been bitten by a sizeable electric shock from a fence, the beast has had its mind implanted with a completely new fence concept. It is this concept of fear which brings respect. It explains how a fence hurdler may be effectively restrained by a top wire that is only knee high. At the same time, fence rubbing and pushing with the resultant fence damage can be brought to a halt.

3. A stockman who for the first time sees a low, light, electric fence is unlikely to be favourably impressed. If, however, such a fence is proved to hold stock permanently in paddocks at less than half the price of the next cheapest fence, we can expect that prejudice will eventually be overcome. (Photos. 1 and 31.)

## The electrical principle

4. The modern high powered low impedance energisers are capable of giving an effective shock even when the live wire passes through tall green grass. (Photo 3.) Electric fences can be effective in most of the circumstances in which conventional fencing is effective. (Photo. 2.)

5. Some of the modern units have a voltage output of 5 000 volts and current flow of 30 to 40 amperes in a short circuit when the earthed animal touches a live wire. The current is put out at approximately one pulse per second. The actual current flow is limited to 3/10 000 of a second per pulse.

6. The effectiveness of the shock depends on the animal being well earthed at the same time that it touches the live wire. When the ground is moist, this in itself provides an adequate earth but in dry times, the animal should be earthed by touching a well earthed wire in the fence line at the same time that it touches the pulsed wire.

## Possible uses

7. *Wherever Conventional Fences are Subject to Deterioration, a Permanent Electrified Wire is worth considering.* An offset electrified wire will make a fence more stockproof and could feasibly add 20 years of life to the fence. (Photos. 4, 5, 6, 32 and 33.)

8. *Wherever new or replacement fences are required, the extremely low cost and effectiveness of the new high powered low impedance type electric fence is worthy of investigation.*

9. The best guide would be a small experiment on the property where new fences are required. Firstly, place cattle in a small conventionally fenced paddock which carries an offset electrified wire. This will educate the cattle to a new bovine concept. Next, let these initiated cattle drift into a paddock which has a cheap low electric fence of the type recommended in this booklet. Try a variation in the height of the top wire. You could be satisfied with a 70 cm (28") top wire though some may go up to 90 cm (36").

## Queensland's need

10. This article on Electric Fencing has been written to meet an obvious need in Queensland—especially where millions of dollars worth of fences have been destroyed in floods. (Photo. 42.)

11. The suggestions that follow are based on individual experiences, composites, and some personal experience.

## Reasons for success

12. Permanent electric fencing with high powered energisers is developing at a rapid rate throughout Victoria and South Australia for both cattle and sheep. It has been going now for ten years and several thousand energisers a year are now being marketed throughout Australia. There is no question that many of the methods being used in the south have direct application to Queensland and some Queensland producers have already proved this.

Photo. 1 This permanent electric fence with a top wire 62 cm (25") from the ground was containing these Shorthorn cows at A.I.A. Exmoor Station, Naracoorte, S.A. (Paragraphs 3 and 89).

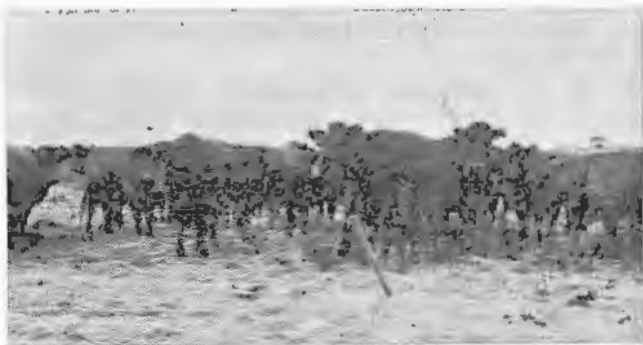


Photo. 2 The eaten out paddock at Exmoor with attractive lucerne in the adjacent paddock demonstrates the reliability of the electric fence. Note the Read Offset Lift Gate. (Paragraph 4).

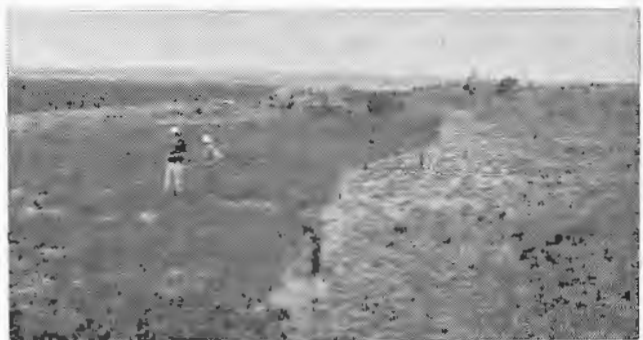


Photo. 3 This electric fence on the Darling Downs still threw a savage spark in spite of the green grass which covered it for three kilometres. (Paragraph 4).

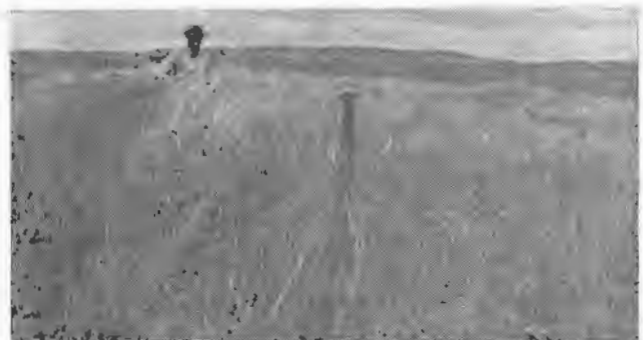


Photo. 4 An offset energised wire can prevent this. (Paragraph 7).



13. There are several reasons for the success of the fence.

14. *It is effective.* Permanent electric fencing is being used successfully from intensive Victorian properties to the Northern Territory. A three wire fence having the top and bottom wires live and the centre as an earth has kept freshly weaned calves from their mothers on at least one Queensland property. A further earth wire at the bottom can make the fence effective for sheep as well as cattle. Emus and kangaroos are plentiful on some of the South Australian properties but they are not regarded as a great menace to electric fences. One property, Exmoor, in South Australia has over 60 kilometres of electrified fence and carries 2 000 head of cattle and 19 000 sheep. Electricity stops fence crawling.

15. *The cost is greatly lower than any other type of fence.* An electric fence would be less

than one quarter the cost of a conventional fence and less than half the cost of a 4 barb suspension fence.

16. *When properly erected it can reduce the cost of fence maintenance* and by using a single electrified wire on an old fence, the life of even a fence in disrepair can be rejuvenated so that it could well last another twenty years or more. Electricity cost is about ten cents per week per energiser.

#### Easy access and cheap gates

17. Where three droppers are used between running posts, motor bikes and vehicles can be taken over the fence. Gates can be built for a very low cost. An electrified 'cocky' gate would cost four or five dollars. A lift gate costing about thirty dollars is an alternative to an ordinary gateway. (Photos. 9 and 10.) (Photos. 36, 37, 38.)

*Photo. 5 An offset electrified wire can add 20 years to an existing fence. As well as preventing physical pressure on the fence, the live wire can turn a poor fence into a stockproof one. (Paragraphs 7, 80, 81). See also Photos. Nos. 47 and 49.*







*Photo. 6 Top Left: A Victorian example of an offset live wire on each side of the fence. Hardwood battens do not require insulators. (Paragraph 7, 80).*

*Photo. 7 Top Right: This light 1.8 metre (6 ft.) hardwood post requires no insulators. It was pointed and driven in for half its length. The strain on each wire is 80 kg (175 lb.). Wire is high tensile. Top wire is 800 mm (32 inches) from the ground. The earth wire and live wire come underground at the gateway. The insulated live wire is protected by putting it inside a length of garden hose when underground. In clay soils the earth wire need not be continuous provided the earth wires in the fence are connected to the ground by a steel post. Note the Ring grip D.C. switch which is a cheap and effective cut out. A single strainer with a low top wire and light strain is one reason for a greatly reduced fence cost. The top and bottom wires in this fence are alive. A further earth wire could be added at the bottom if sheep were to be run. The cheap wire or cocky gate is effective when electrified. (Paragraphs 27, 47).*



*Photo. 8 Bottom Right: This bull paddock has a top wire 700 mm (28") from ground level. (Paragraph 90).*



**18. Labour for mustering can be reduced.** The low cost of erection has opened the way for *laneways* running from one end of a property to another. If these are 50 metres wide they can also be used as paddocks.

**19. Fencing on the contour for soil erosion control is greatly simplified** as the lightness of posts and the light strain required on wires means that straight line fencing is no longer essential.

**20. Quick erection is a feature of the fence.** Two men can erect 2 kilometres of fence in a day with no machinery being necessary. One southern contractor uses a 40 mm (1½") circumference rope with a wrap-on technique to strain his wires.

### Electricity failures

**21.** A common question asked is how long does the fence remain effective when there is a complete absence of electricity either through a bad short or a power failure? Under normal grazing conditions it is likely that the uncharged fence could remain an effective barrier to cattle and sheep for several weeks.

**22.** Under highly intensive grazing however, a fault may be discovered by cattle within an hour or so of it occurring. This would be when cattle are forced to eat the last mouthful in a paddock before being moved to attractive feed in the adjoining paddock. Under such extreme conditions there are usually some cattle which are continually reaching for a bite underneath the bottom wire. This type of animal occasionally touches the wire by accident and if it receives no shock, it may keep pushing until through.

**23. New techniques are being developed almost weekly** by producers and fencing consultants who are on the look-out for improvement. In many cases, we can expect to see educated cattle being held by one and two wire fences.

### Seven musts for successful electric fencing

**24.** There are *several musts* if electric fencing is going to be used successfully. If these points are not going to be observed it would be better not to embark on an electric fencing programme.

The seven musts for Electric Fencing concern:—

INSULATION;  
CONNECTIONS;  
EARTHING;  
CUT-OUT POINTS;  
ENERGISERS;  
TESTING FOR FAULTS; and  
STOCKMANSHIP.

### Insulation

**25.** The greatest hindrance to the electric fence is the short-circuit which is usually avoidable.

**26.** High density timber such as ironbark is in itself a great insulator and it is possible to have many kilometres of effective electric fence with posts and droppers made from this timber. This means that the problem of earthing out onto iron posts has been eliminated and broken insulators do not exist. High density posts when wet from rain do not present a problem. Attachment to droppers and posts is best done by tying on. One Queensland property at Goomeri has successfully used 4 000 split, untreated ironbark posts without insulators. One energiser in this case was giving an effective shock along 16 kilometres of fence. As the posts were at 3·1 metre intervals, there was about ten times the contact of timber to ground as with the long panels suggested in this article. (**Photo 11**). This example shows that under such circumstances, insulators are unnecessary. Though barb wire is not recommended it was being used in this instance and was strained onto ironbark posts in the conventional way.

**27.** Some of the less dense hardwoods may need to be creosoted. The principal advantages of this would be to reduce moisture absorption and increase life. Where doubt exists, insulators could be used at strainer posts where the pressure of wire on the strainer makes a much firmer contact. (**Photo 7**).

**28.** By far the best insulator to use is the porcelain one. A cotton reel or bobbin type 38 mm (1½") in diameter is adequate for straining. Porcelain is superior to any of the plastic type insulators—being unaffected by sun and fire. Where there is no porcelain available, use black synthetics which resist the sun's ultra-violet rays more effectively than white or coloured synthetic insulators. (**Photo 41**).



Photo. 9 Top Left: Mr. Robert Rymill, Penola Station, South Australia, uses his gumboots to ground the wires while he crosses on motor bike. Where battens are used, the bikes are put over at the batten. (Paragraph 17).

Photo. 10 Top right: This angled bull bar is used to flatten the fence at almost any point on Exmoor Station, South Australia. To avoid the wire becoming caught on the back springs, an inverted spring leaf is attached underneath the vehicle on each side in front of the rear spring. (Paragraph 17).

Photo. 11 Bottom left: This electric fence was part of 16 kilometres which involved 4 000 split ironbark posts which were untreated. As the fence in the Goomeri district has proved satisfactory over a number of years it provides practical evidence that high density timbers such as ironbark do not require treatment nor insulators, under normal circumstances. (Paragraph 26).





*Photo. 12 The highest powered energisers such as this one will flash a 240 volt, 150 watt globe. This test of output gives a basis of comparison. Units which will flash a 25 watt bulb have proved satisfactory for 10 to 15 kilometres of fencing. (Paragraph 51).*

**29.** If untreated hardwood is decided against, hardwood treated with creosote under pressure can be purchased. Droppers (38 mm x 25 mm), running posts (48 mm x 38 mm) and round posts are available in Toowoomba. Untreated ironbark posts pointed and bored are available at Toowoomba and Chinchilla.

**30.** The next choice would be creosoted pine. This is used extensively in the south—mainly because there is no ready access to sufficient quantities of high density hardwoods. (**Photo 21**). Copper, chrome, arsenic (CCA) treated posts do not compare with untreated hardwood or creosoted timber because the salt in the treatment is a conductor of electricity.

**31.** Steel posts have many advantages but their high conductivity sends any electric current direct to earth when touched by a live wire. Where length of fences are great this is a risk that is best avoided. Also, steel posts are over three times the price of hardwood running posts.

**32.** Where especially moist circumstances apply as in wet coastal areas, slit nylon sleeves

can be used where tie-ons are made to droppers and posts though sleeves encourage rust.

**33.** The producer who goes to buy insulators could easily be bewildered by the limitless array of plastic and polythene insulators. Although the artistry of some is worthy of a prize, porcelain is still the best.

**34.** Where a live wire is passed underground, such as at a conventional gateway, the wire should be thickly insulated—preferably galvanised and encased in plastic garden hose or 12 mm ( $\frac{1}{2}$ "") polythene pipe.

**35.** Care in insulation is critical though it will be appreciated that more attention will be required under moist conditions than say in the dry inland. Also, where long lengths of fenceline—say 30 km—are run off the one high powered energiser in high rainfall areas the compounding effect of imperfect insulators could well justify more care with droppers and posts. In such cases any tying of wires to droppers and posts should be no tighter than necessary as subsurface moisture of posts and droppers may be contacted. Loose tying also permits wires to run—increasing elasticity.

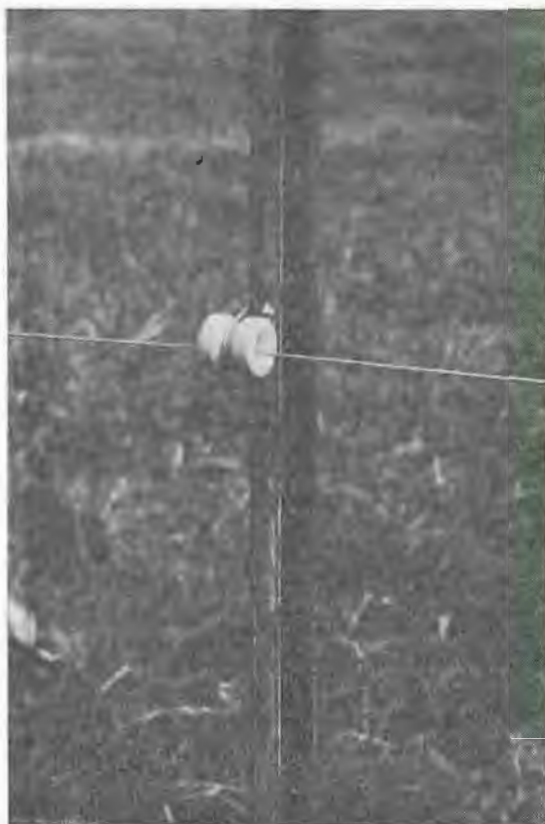


Photo. 13 Top left: This 30 mm (1¼") diameter porcelain insulator with prefabricated wire clip and bolt have proved satisfactory where steel posts have to be used. (Paragraph 37).

Photo. 14 Top right: An effective earth is essential. The casing for a bore makes an excellent earth. The galvanised pipe in the photo has been driven 2 metres into the ground at a permanently moist spot, and is connected by wire to the energiser's earth terminal. (Paragraph 41).



Photo. 15 Bottom left: The earth wire is made effective by firmly tying to unpainted steel posts. A sleeve of garden hose insulates the connecting wire from the bottom live wire. Steel posts are driven in full length about every kilometre. Use galvanised post or pipe in ground when steel posts rust or corrode quickly. (Paragraph 42).

36. Staples should be used sparingly as staples can cause splitting of timber and so protect moist areas.

37. Where steel star posts are used, the best insulator in terms of a combination of cost and effectiveness is a porcelain bobbin 30 mm (1¼") in diameter which is threaded onto the wire and attached by a simple prefabricated clip that is bolted to a hole in the post. Where the wires have been already run, a special porcelain insulator can be bolted to the post and the run wires inserted. (Photo 13).



*Photo. 16 This voltmeter will tell immediately if there is a power leakage on the fence line. The voltage drops between the energiser and the fault but after the fault it remains constant. This will enable the operator to tell whether the fault is between him and the energiser or whether the test is being made between the fault and the energiser. (Paragraph 61).*

**38.** Loose wires or pieces of wire lying about should be continually guarded against.

### Connections

**39.** These should be firm yet not conducive to rust or corrosion. As galvanised high tensile wire is recommended for electric fences, the rule should be 'connect galvanised to galvanised'. It is now possible to buy galvanised insulated wire. This means that this can be directly connected to the energiser terminal. The connection to the fence wire can be made effectively by a galvanised high tensile spiral (or curl-on terminator). This spiral has a galvanised bolt at one end to connect to the insulated galvanised wire and contact on the fence line is made by virtue of the pressure from the spiralled high tensile design. If simply using a length of high tensile wire for a connection, be sure that the contact points are

firm. This can be achieved by using garden hose over the connecting wire which can be firmly secured as illustrated.

**40.** Wrapping any wire round and round looks neat but invites rust. Initial attention to good connection points could avoid hours of fault finding over the years.

### Earthing

**41.** The principle of the electric shock is based on the animal completing the circuit from the live wire to earth. The earth terminal on the energiser is connected by wire to a permanently moist area. The ground casing of a bore or a 2 metre galvanised stake or pipe driven full length into a moist area will be effective where the connections are well made. When the animal is standing on moist ground, it will receive the full effect of the shock when it touches the live wire. (Photo 14).





Photo. 17 Cheap, yet effective cut out. High tensile 1.6 gauge wire is connected to the top wire and shaped to keep plastic grip in place and with the hook at the end. Insulated galvanised wire carries power from under the gateway. Both wires can be handled when live. Firmness of contact is maintained by tying insulated galvanised wire down to earth wire. (Paragraph 48).



Photo. 18 This energiser has been set up in a control box designed by Mr. Robert Rymill of Penola Station. An energiser, centrally situated with cut out switches and a voltmeter enables the operator to quickly identify the section of fence in which the fault exists. (Paragraph 47). See also Photo No. 50.



Photo. 19 This wind charger has kept a 12 volt battery effective for 3 years on Exmoor Station. A 12 volt car battery will keep 12-15 kilometres of fence electrified for 2-3 weeks with an energiser that gives a good spark. (Paragraph 55).

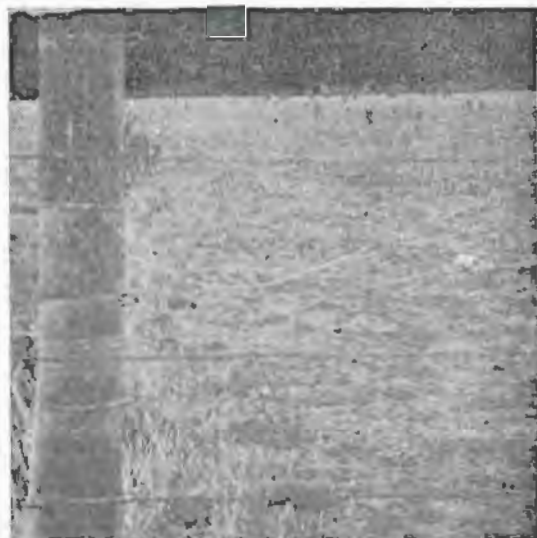


Photo. 20 A training paddock. Note the porcelain insulator which can be seen through the top and second top wires of the conventional fence. The live wire is run inside the paddock at a distance of about 800 mm above the ground and 800 mm in from the conventional fence. (Paragraph 75).



**42.** In most of Queensland, the ground develops a dry insulating surface for several months of the year. This dry surface can render the electric fence ineffective unless at least one of the wires in the fence is in contact with sub-surface moisture. In some cases, this is done by connecting the earth wire or wires to the moist ground by means of steel stakes driven 2 metres into the ground at intervals of about one kilometre. (Photo 15). Where steel posts are used in the fence itself, these alone will commonly provide sufficient earth contact for the earth wires. Sandy soils are more insulating than clay soils.

**43.** In many cases an earth wire is run continuously throughout the total electric fence system, having contact with the energiser and the earth electrode to which the energiser's earth terminal is connected. The effectiveness of the earth wire can be tested by connecting it and a live wire to a voltmeter or even by seeing what sort of spark can be produced between the two wires. Where 2 earth wires are used, these should of course be connected. Take care to connect them with insulated wire so as to avoid shorting out against live wires.

**44.** When the animal makes contact with both the live wire and the earth wire, it completes the circuit and gets the full jolt of the 4 500 volts or so. Experienced users of an electric fence under dry conditions appreciate that taking much care with the earth return wire is a priority.

**45.** Where moist conditions prevail, the ground will provide a sufficient earth contact for the animal. In such cases, it is best to have all of the wires in the fence electrified or at least insulated as this eliminates the short circuit which occurs when the live wire makes contact with an earthed wire.

**46.** Touching the live wire with a piece of green grass will usually give a small bearable shock but if the earth wire is well earthed, grabbing it with the other hand will result in a much bigger shock through the grass contact. When earthing is not effective, holding the earth wire with one hand and pressing firmly on the ground with the other hand will result in a small shock.

### Cut out points

**47.** Troubles can be best traced if the various electrified sections radiate from the energiser and each line in turn can be disconnected. Some properties use D.C. Ring Grip switches costing about \$2.00. These have a much wider gap than modern 240 volt household switches. The spiral terminators are sufficient—provided of course that you earth out the live wires before handling the terminator. Where connection is made by hooking on wire, be sure that the contact is firm and secure. Control boxes with several switches can be purchased. (Photos. 7 and 18).

**48.** At fence line junctions and every kilometre or so along a straight line, a cut out point will aid in locating where a fault lies. Cut outs are also made from fuse plugs but the type used may depend on the cost. Insulated wire that is hooked at each end has been used effectively. (Photo 17). The wire should be galvanised to avoid corrosion.

### Energiser





**49.** The high voltage low impedance energisers range up to 5 000 volts. The mains units are plugged into a 240 volt system with an ordinary three-point plug.

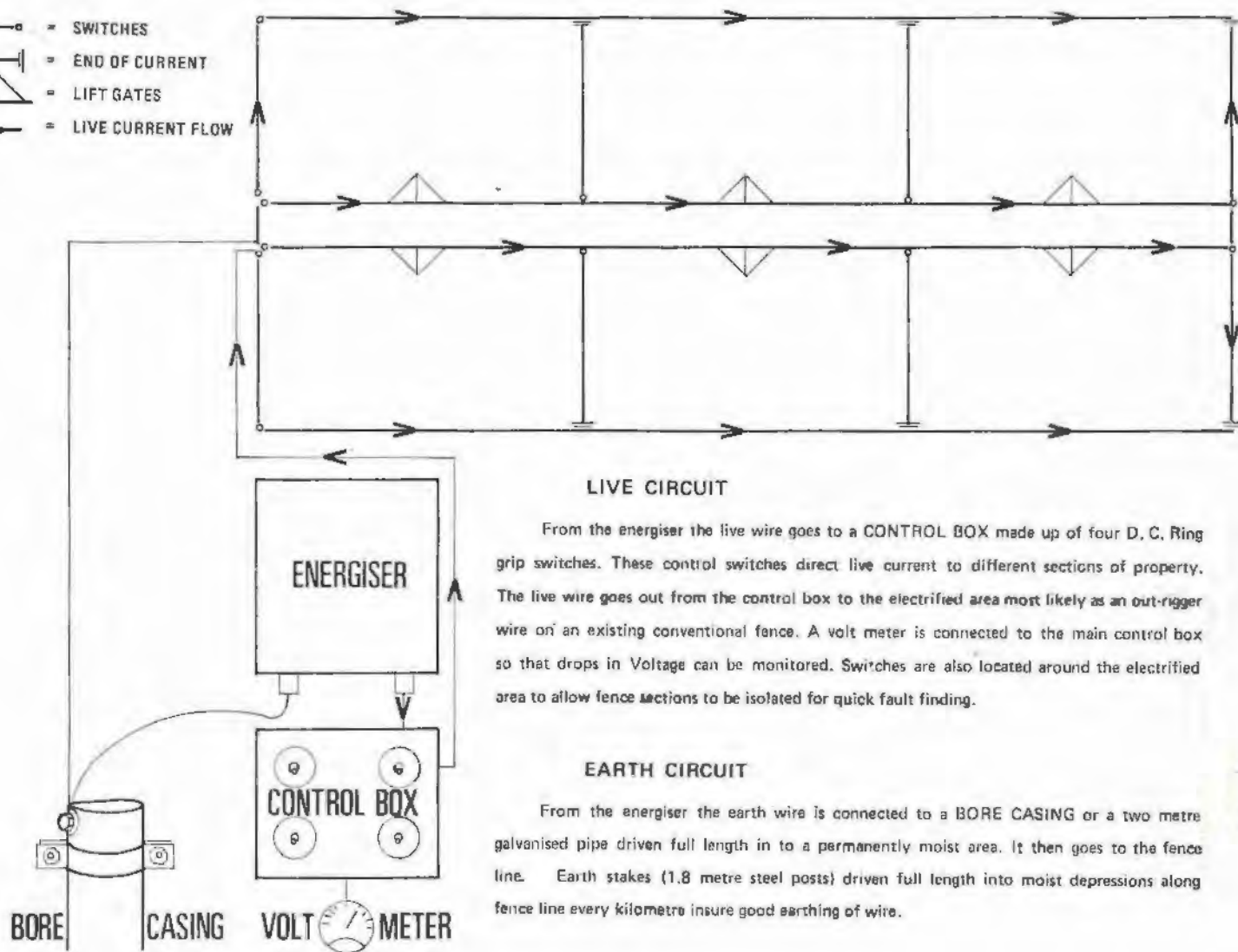
**50.** High voltage, in practical terms, means that there is a build up of a high electrical pressure and 'low impedance' means that the electrified wire will stand a considerable quantity of green vegetation on it before it fails to produce an effective pulse at the end of several kilometres of fence.

### Comparing Energiser Output

**51.** Many energisers will give a reading of around 5 000 volts with a voltmeter, but this does not give an indication of current flow.

**52.** The highest powered units allowed under safety regulations will flash a 150 watt, 240 volt light globe when connected to the live and earth terminals. (Photo 12). These energisers should charge 30 to 40 km of fence. Smaller powered units will flash a 25 watt bulb and give a weaker flash with a 40 watt globe. These will energise about 15 to 25 km of fenceline—depending largely on the efficiency of the insulation; the gauge and condition of the wire and whether the fence is in a long line or radiates from a central point. The latter is more efficient.

-  SWITCHES
-  END OF CURRENT
-  LIFT GATES
-  LIVE CURRENT FLOW



### LIVE CIRCUIT

From the energiser the live wire goes to a **CONTROL BOX** made up of four D. C. Ring grip switches. These control switches direct live current to different sections of property. The live wire goes out from the control box to the electrified area most likely as an out-rigger wire on an existing conventional fence. A volt meter is connected to the main control box so that drops in Voltage can be monitored. Switches are also located around the electrified area to allow fence sections to be isolated for quick fault finding.

### EARTH CIRCUIT

From the energiser the earth wire is connected to a **BORE CASING** or a two metre galvanised pipe driven full length in to a permanently moist area. It then goes to the fence line. Earth stakes (1.8 metre steel posts) driven full length into moist depressions along fence line every kilometre insure good earthing of wire.

53. Under ideal conditions, energisers may prove to be effective over greater distances than have been indicated here. The use, however, of more than one energiser over long distances may amount to a cost of less than ten dollars per kilometre and at the same time a fault on one line of fence will still mean that fences energised by the other unit will not be affected by the short.

54. The cost of electricity for a mains powered energiser is usually less than 10 cents per week when the energiser is run continuously.

55. Some makers produce a high voltage—low impedance energiser that is powered by a 12 volt car battery. Units which will flick a 40 watt globe will energise up to about 15 km of fence. The batteries need to be changed every two or three weeks. One property, Exmoor, in South Australia, powers the battery with a wind generator. (Photo. 19).

56. The two most common brands of high powered energisers used in Queensland are imported from New Zealand where the mains type high powered permanent electric fencing system originated.

57. Some Energisers available in Queensland with their input power ratings are:

HIGH POWERED (Mains)	INPUT RATING
Gallagher BEV11	17 watts
Waikato E/4	20 watts
MEDIUM POWERED (Mains)	
Electra 240	5 watts
Waikato E/3	5 watts

#### *Battery Operated Units*

58. The Gallagher SB 24–32 volt unit will give the same output as the high powered mains units though, because it draws 300–400 mA. It is only suitable when the batteries are consistently being charged such as with a 32 volt lighting plant.

59. The Gallagher E12 runs from a 12 volt battery drawing 100–150 mA. Another fairly commonly used unit is the Electra HV12 volt which draws 60 mA. In addition to these commonly marketed energisers, there are many others.

60. Most energisers of the modern type fell within the price range of \$90 to \$145 in October, 1976. The input power rating while being a general guide to the current output, is not necessarily exactly relative.

#### **Testing for faults**

61. Testing is best done with a voltmeter, (Photo. 16). There are some on the market which cost less than forty dollars. Cheaper testers can be purchased to indicate the relative shockability of the fence.

62. If caught out on the fence line without a voltmeter, you can still test for the pressure of current by connecting any piece of wire with the earth wire and then hold the wire very close to the live wire to see if there is a spark. A piece of green grass held by the hand on the live wire will also indicate if there is any current. With experience, an operator will get a fair idea of the degree of electricity leakage by the size of the spark.

63. When there is a short on the line the voltage continues to drop from the energiser to the short. After the short, the voltage is either zero or constant. *It is a sound plan to have a voltmeter available at the energiser and to develop the routine of a daily check.* Most energisers flash a built-in light with each pulse to indicate that the fence is alive. Provided it is carefully treated a voltmeter can also be carried on a motor bike or in a vehicle as a standard piece of equipment.

64. Well over 90% of weak shocks result from shorting out, poor connections or a poor earthing system. Rarely is the energiser at fault and this can always be tested by disconnecting the fence and testing the energiser at its terminals.

65. The experiences of southern cattle and sheep men is that they might have a fault in the fence at the rate of one a week to one in three months. A number of these were caused by wires crossing after a motor bike or vehicle had crossed over the fence.

66. The time taken to find a fault usually varied between five and thirty minutes. Gathering up stray pieces of wire and tightening loose wires will reduce faults considerably. Quick location of faults depends much on the basic layout of the total fencing system. Ideally the energiser would be near the house in the middle of the property with the sections radiating out—perhaps in four or more sections. If the daily check at the energiser indicates a loss in voltage, the fault can then be systematically and speedily located.



*Photo. 21 This easysel post is the standard permanent electric fence running post in western Victoria and south-east South Australia. The post is made of semi-dense hardwood, is multi-grooved and creosoted. Its measurement is 50 mm x 37 mm x 1350 mm (2" x 1½" x 4'6"). It is driven in the ground 450 mm so as to be 900 mm (36") above ground level. The wires on both this and the drop-pers (or battens) are wired with G4P clips. High density hardwood such as ironbark does not need to be creosoted and can be bored so as to attach the wires to the post with tie wire. (Paragraphs 29, 110-117).*

**67.** By switching each section off in turn, the section on which the fault exists can be identified. This is because the voltage will pick up immediately the faulty line is switched off. Whilst a voltmeter is ideal for checking voltage drop, the cheaper indicators can be used. Some

producers tell by the intensity of the flashing light on the energiser or by the sound of the energiser as to whether there is any appreciable leakage.

**68.** After the section of fence has been identified, it is then a matter of having it switched on and going along to that section and switching each sub-section off at junctions and then follow along the line which continues to show a leakage as shown by the indicator or by a weak spark. A piece of wire held onto the earth wire and held close to the live wire, will show a spark without giving a shock. Mr. E. Wark of Tingha, N.S.W., uses a carpenter's pencil for this purpose.

**69.** Once the sub-section is located, it is a matter of finding the fault in that section. Where lines of electric fence are several kilometres long, it would be wise to keep sections between junctions to 1 kilometre or less.

**70.** Some basic planning before electrifying will reduce to a minimum the loss of time in fault finding. When handling wires, the connecting of the live and earth wires will short out the whole fence and so prevent shocks.

### **Stockmanship**

**71.** For a stockman to appreciate an electric fence it is necessary that he attempts to see the fence from the animal's point of view. The whole system is built on the animal's respect for the fence. This respect is created by the animal associating the wire with an overwhelming, unpleasant shock to his system. This means he must experience at least one shock, and preferably by a gentle touch, so that he mentally registers exactly what he did to receive the shock. If the shock is a sizeable one, you can be sure that he will aim at avoiding the fence while memory lasts.

**72.** Many southern properties take no particular pains in educating the cattle to permanent electric fencing except to have fresh uneducated cattle drifting into a paddock rather than rushing in. With the low fences, which are becoming commonplace in the south, new cattle should not have any attraction across the fence, such as other cattle, otherwise the uninitiated cattle are likely to run across the fence and have too much momentum for the pulse to stop them.



73. A sound idea is to have a small but substantial holding paddock adjoining the yard where cattle enter the property. This could be a 5 wire fence with 3 live wires. A conventional fence with an offset live wire will usually do. Spreading some hay around the fence will ensure fence contact by cattle and so develop a respect for other wire barriers.

74. Most users of electric fences have no complaints about stock getting through fences. It is, however, often necessary to put a live wire across conventional gates as they can be worn out by rubbing.

75. Some cattlemen have a live wire in a small paddock about .6 metres inside a conventional fence and this is used to educate weaners and new cattle. An offset wire on a conventional fence is ideal. (Photos 20 and 33).

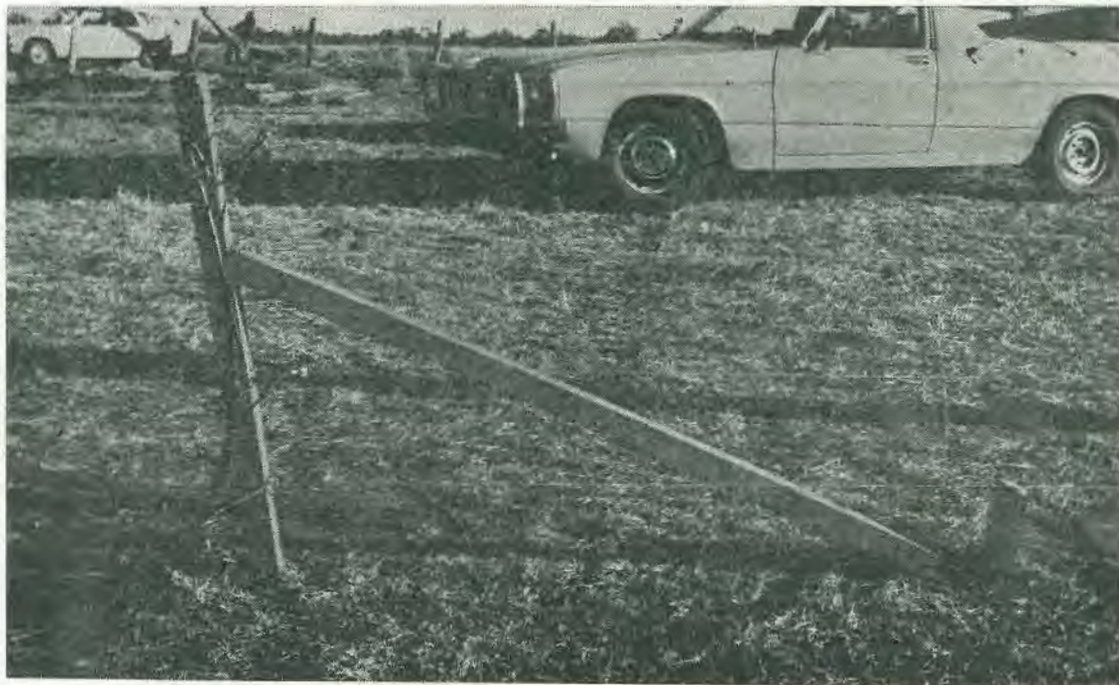
76. Sheepmen say that sheep are best taught to have respect for the fence as lambs when they have little wool to insulate them. Otherwise sheep can be educated when they are freshly off-shears.

77. Cattlemen will realise that at times when a beast is in a frenzy, it may blindly attack any barrier. In these circumstances it could be argued that a low, elastic fence with no barbs is the one which is more likely to remain undamaged from such an animal.

78. Where animals are so frightened that it is difficult to get them through a gateway, they can be conditioned by leaving the gate in the open position and spreading some hay on either side of the opening.

79. While the electric shock is painful, the animal quickly recovers—far quicker than if it were ripped by barb wire.

*Photo. 22 A 50 x 50 x 1 500 mm ironbark post with angled ironbark stay makes a suitable strainer when stayed with a piece of 50 x 50 x 1 800 mm. The stay is best attached to post and peg by boring each end and inserting 100 mm lengths of  $\frac{3}{8}$ " steel rod at each end which are inserted into the post and peg respectively. The top of the peg is driven to ground level. (Paragraphs 111 and 113).*

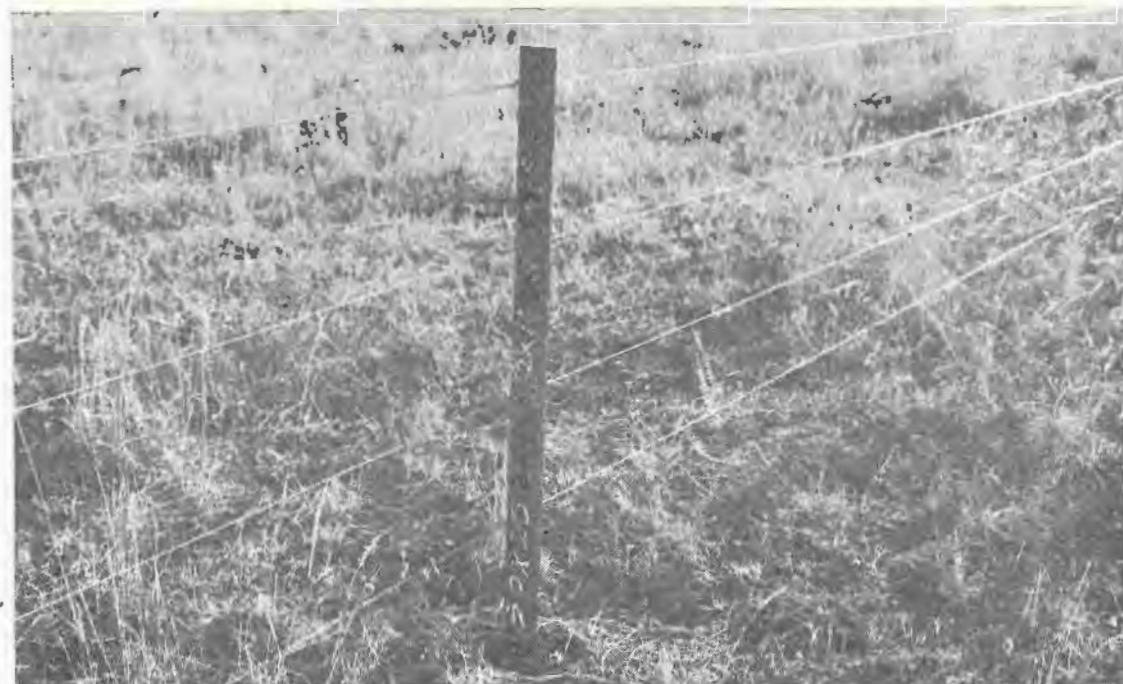






**Photo. 23** This 75 x 75 x 1 500 mm ironbark corner post in clay and loam soils is more effective if stayed on the inside in a similar manner to the strainer in Photo 22. Wires are loosely stapled to the post to allow lateral movement when tension is applied to the wire. When driven the post remains 900 mm (36") out of the ground. (Paragraph 108).

**Photo. 24** A 50 x 25 x 1 350 mm (2" x 1" x 4'6") ironbark running post. It is pointed and bored. Spacings from the top, in Imperial measurements, are 2", 10", 9", 8" and 7". The fourth wire is for sheep. Distances between posts are from 14 to 20 metres. (Paragraph 102).



## Uses and erection of electric fences

### Existing fences improved

**80.** Existing fences on a property can be far more effective if they are upgraded by running a live wire along them. This will result in longer fence life as physical pressures such as rubbing and pushing through the fence come to an immediate end. This running of a live wire along an existing fence is also an ideal method of taking the power from your energiser to an outlying area which requires electrified subdivision. Where conventional fences that are in a state of disrepair are to be upgraded, loose wires must be eliminated. Otherwise they will cause constant earthing-out problems. (Photos. 4, 5, 6, 32, 33).

**81.** There are several methods of running an outrigger along existing fences. They include—

(i) a 'V' shaped heavy high tensile wire which has a porcelain insulator at its angle and the ends of the V's legs are bent so as to attach to two wires of the existing fence. Usually such a wire should be about .8 metres

above ground level. If the wire droppers that are used for suspension fences are on hand, these can be bent to hold the insulators in a similar way. (Photo. 5).

82. (ii) Where wooden or steel posts are in the fence a hardwood batten about 400 millimetres long with a hole bored in each end and two holes bored close to the centre can be tied on every 30 metres with soft wire. It is often preferable to run a live wire on each side of such a fence. When all posts in the fence are hardwood, it could be preferable to energise one of the wires that is already in the fence.

83. (iii) In some circumstances it could be just as cheap and effective to support the wire on 50 mm x 25 mm hardwood posts

driven in every 30 metres, or at more frequent intervals where the country is hilly or undulating. This live wire would be offset from the fence by about 200 mm.

84. (iv) Two wooden battens bored at each end can have the offset wire running through the holes at one end while the other ends form the legs of the V and are wired to the wire on opposite sides of a post. A Y offset can be made by shortening one of the battens and bolting them.

### Paddock layout

85. Thought should be given to fencing the property in a way which will best fit management of feed, handling of cattle, avoid soil erosion and allow ready tracing of faults.

86. Special consideration should be given to labour saving lanes. Narrow lanes are a problem as they can result in worn, overstocked and overtrampled areas which encourage weed growth and erosion. Also, when driving cattle along there may need to be sufficient width to allow the musterer to overtake the stock when necessary.

87. If lanes are about 50 metres or more wide they can also be used as paddocks.

88. Offset, lift-gates, or electrified cocky gates, because they are cheap and effective, can be placed wherever they are required.

### Fence design

89. The effect that the electric fence has on livestock is the real test as to whether it is stockproof or not. At one watering point on Exmoor Station, South Australia which runs 2 000 cattle and 19 000 sheep, the fences came to an acute angle with the top wire being as low as 650 mm (25") above ground level. The Shorthorn cows in this paddock had made no attempt to go over the fence in the few weeks that they had been there—even though feed was in short supply. This situation was quite normal in the extensive experience of the manager, Mr. J. Rose. (Photo. 1).

90. When you see this type of scene repeated many times under different circumstances and hear the evidence from cattlemen who have used electric fences successfully for years, you have strong reason to believe that the principle of operation is quite different to that of a conventional fence. (Photo. 8).



Photo. 25 Mr. R. Pontifex, Biddeston, with a post driver made from bore casing. (Paragraph 114).



91. Nevertheless it is understandable that Queenslanders, used to 1.2 metre (46") top wires will find an 850 mm (34") fence almost unthinkable. If, however, the cattleman is interested in cutting fencing costs by more than half, this should provide sufficient incentive to try a small section of low electric fence to prove to himself its effectiveness or otherwise.

92. The main reasons for the low cost of the electric fence are that the posts are lighter and fewer, the wires are plain and fewer in number and the lighter strain on the wires does away for the need for costly strainer assemblies.

93. If a beast is being chased at the gallop, the electric fence is unlikely to stop him. On the other hand if cattle are rushed over a light elastic fence, the time and cost of repairing the fence is likely to be much less than a tightly strained conventional fence that is hit by a mob at the gallop.



Photo. 26 A Piesse Pylola is used for putting down pilot holes for posts. The diamond point is rammed down in post driver fashion. Two bolts near the bottom of the handles act as stops so that when bumping the bar upwards out of the hole, the bolts contact the head of the bar which slides inside the hollow section. The ledge can be used for driving running posts though close fitting drivers allow better control of the post. (Paragraph 114).

## Type of wire

94. For long distances of fence, say over 10 kilometres, the best wire to use is 2.50 mm (12½ gauge) plain, high tensile, heavy galvanised with a breaking strain of 390 kg (850 lb.). This wire is marketed in Australia by Australian Wire Industries as Flexabel Heavy Galvanised. In September, 1976, the price in Brisbane for this product was \$31.90 per 1 500 metre coil. The same wire in Standard galvanised was priced at \$25.40. The heavy galvanising is considered by the manufacturers to give at least three times the life of the standard galvanising under average conditions. 2.50 mm gauge is the most efficient gauge for carrying current. Though it requires heavier staining than smaller gauges, it is stronger and can be seen more easily by stock. This can be an important point where paddocks are bigger and cattle are not as familiar with the placement of fences as those in smaller paddocks.

95. Many producers have used 1.80 mm (15 gauge) successfully though it has double the resistance to 2.50 mm wire. 1.6 mm (16 gauge) wire is only sold in the heavy galvanised form. While it is more difficult to see, it is very cheap, easy to handle when erecting the fence and is so light that it can be strained up by hand. A 50 kg coil of this wire cost \$34.55 in Brisbane at September, 1976, and contained 3 040 metres or sufficient to build a kilometre of three wire fence.

96. Barb wire is not as efficient with electricity nor as easy to handle but apart from that, it could prove unpleasant to an animal or human who became caught in the fence and sustained a series of shocks.

97. High tensile wire is easily kinked when running it out from the coil. For this reason it is best run with the aid of a spinner. A suitable method is to tie the wire to the strainer post and place the spinner and wire on a carry-all or vehicle. Every effort should be made to keep joins to a minimum—thus reducing the possibility of hooked wires.

98. Mr. H. Beasley, Chinchilla, has made a simple but effective wire spinner from two one metre lengths of 75 mm x 50 mm hardwood. These are both joggled at their centres so as to form a cross. A hole is bored through the intersection sufficient to take a 1 metre



length of steel rod 20 mm in diameter. The cross is placed on a plough disc (convex side up) which in turn sits on a car wheel. The wire coil is held in place on the cross by 4 upright steel lengths about 10 mm in diameter, which fit the inside diameter of the coil. The spinner is anchored by driving the length of steel rod through the holes of the cross, disc and wheel and into the ground. (Photo. 35). Alternatively the spinner could be anchored to the vehicle or carry-all and the wire unwound from the coil as it travelled along the fenceline.



Photo. 27 This "Piesse Pylola" is a combined crowbar and post driver. The crowbar slides inside the pipe until it hits solid metal—driving the bar into the ground. Then, to drive an easyset post, the point of the bar is positioned 6 or 8 centimetres from the hole. The post is placed in the hole and driven by a metal plate which can be seen protruding near the operator's hands. The crowbar acts as a guide while the driving section is slid up and down the bar in order to drive the post. (Paragraph 114).

## Number of wires and spacings

99. Of five leading properties using electric fencing that were visited in South Australia and Victoria, which ran both sheep and cattle, the highest top wire was 900 mm (36") and the lowest top wire was 700 mm (28"). All properties had four wires and all ran both sheep and cattle. One manager with considerable experience had found that a three wire fence was adequate when cattle only were run.

100. When only cattle are being run, three wires are adequate. The top and bottom can be live with the centre wire earthed. This order can be reversed and could enable a longer length of fence to be energised. When a body of lush pasture growth causes severe leakage of current, only electrify the top one or two wires—depending on the height of the vegetation. With ironbark posts, the advantage of being able to electrify any wire readily is considerable.

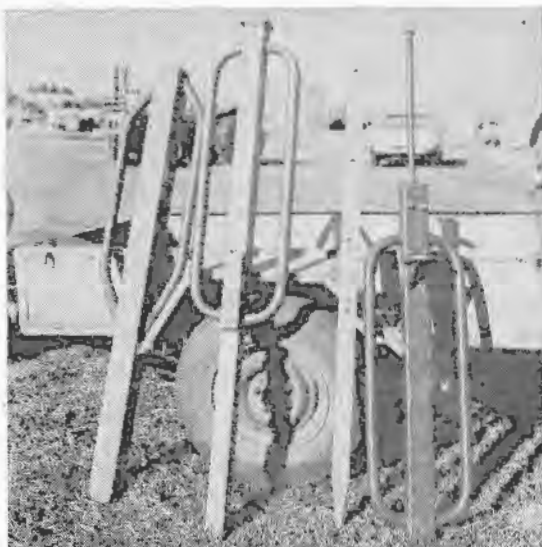


Photo. 28 Suitable drivers for milled posts shown with a Pylola. (Paragraph 114).

Photo. 29 This 7 metre length of 37 cm circumference rope will enable the operator to put over 90 kg (198 lb.) strain on a wire. About 500 mm of the end of the rope is wrapped around the wire so that the wire runs through the centre of the rope. (Paragraph 107).



Photo. 30 This simple wire strain gauge can be constructed with a board, 3 nails and a spring scales. The two extreme nails are 1 000 mm apart and are placed below the wire. The centre nail is midway but offset by 15 mm. The weight required to pull the wire to touch the offset nail should be multiplied by 20, e.g. 4 kg on scales  $\times 20 = 80$  kg on the wire. (Paragraph 106).



Photo. 31 Though at least 2 wires (one earth and one live) are recommended, this single wire on flood flats at Ellangowan on the Condamine has effectively kept cattle out of crop for 15 months. (Paragraph 3).



**101.** With a four wire fence all spacings are about 200 mm (8") and from the bottom, the wires are earth, live, earth, live. This has proved effective for cattle and crossbred and Merino sheep. In some cases the top spacing was 250 mm (10").

**102.** With imperial measurements, a handy rule is to have posts out of the ground 36". The top wire is 2" from the top at 34" then the spaces between wires from the top to the bottom are 10, 9, 8 (being to the fourth wire for sheep) and 7 to the ground. (Photo. 24.) In metric, these distances are post 900 mm above ground then holes at 850, 600, 375 and 175 mm (for sheep). Where sheep dogs are used, it is important that the bottom wire of the four wire fence always be earthed.

**103.** Some properties were set up so that all wires could be insulated from the ground. When the ground was damp all of the wires would be electrified and in this way there could be no short circuit between wires. When cattle are educated, two wire fences could prove adequate and where the ground provides an effective means of earthing. One wire has been used to hold cattle off crop, over a period of two years on the Downs.

### Wire tension

**104.** Because the fence is a psychological rather than a physical barrier, it is not necessary to have any more tension than is necessary to avoid undue sag in the wires.

**105.** The tension on high tensile wire should vary according to the gauge used. The following tensions are suggested: 1.6 mm (16 gauge) 40 kg (90 lb.); 1.80 mm (15 gauge) 60 kg (132 lb.); and 2.50 mm (12½ gauge) 80 kg (176 lb.). Usually the tension drops lower than these figures without any sag in the wires being obvious.

**106.** These relatively light tensions which are less than half those in conventional fencing have the advantages of being easy to strain, putting far less pressure than normal on the strainer post and allow a much greater degree of elasticity in the wire. Much of the elasticity is lost from wire when it is overstrained. Wire tension meters can be bought. A simple one is illustrated. (Photo. 30.)



*Photo. 32 A double sided offset ironbark batten, 38 x 25 x 500 mm (1½" x 1" x 20") is of best use for a fence in bad condition. (Paragraphs 7, 80).*

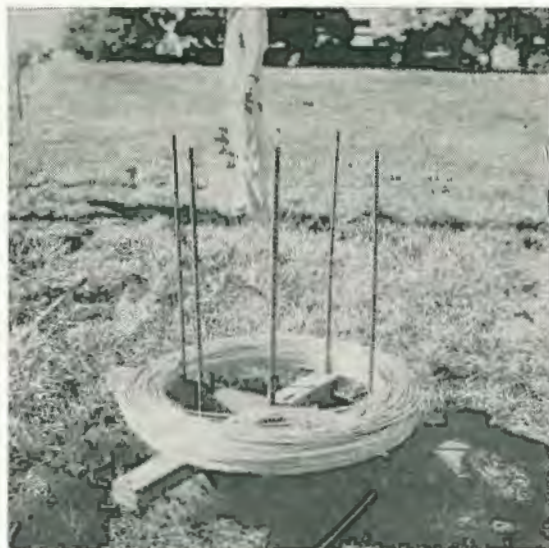
**107.** Mr. Brian Baulch of Hawkesdale, Victoria, uses a 6 metre length of hemp rope of 37 mm (1½") diameter. About .5 metres of this rope is wrapped around the wire and by using a hay knot the wire can be strained to 110 kg before it slips. To wrap the rope around the wire, the rope is untwisted a little at a time (not unravelled) and allowed to twist back over the wire so that the wire is actually running through the centre of the rope. (Photo. 29.)

**108.** Where practicable, wire should be strained around corners. If a beast runs into the fence near such a corner, fence elasticity will minimize broken wires. With dense hardwood corner posts, run the wire outside and hold in position with 20 mm staples which are not driven fully home. This permits horizontal movement of the wire. Where insulators are necessary, use porcelain bobbins (50 mm) on the inside so that they act as pulleys. An unstayed corner post should be leant out about 7 degrees (175 mm with a 900 mm high post) and driven in .6 metres in say black soil. (Photos. 23 and 43.)





**Photo. 33** These two battens, 38 x 25 x 350 mm (1½" x 1" x 12") are for offsetting a wire. Another method is to have the battens unseparated by the post. Tie them together where they meet and tie on the running wire. Price is around 18 cents per pair. (Paragraphs 7, 80 and 84).



**Photo. 35** A useful home-made wire spinner made from 2 pieces of timber 75 x 50 x 1110 mm (3" x 2" x 44"). Timber is joggled at point of intersection and bored to take metal axis rod. The cross sits on an old plough disc which in turn sits on a car wheel and tyre. (Paragraph 98).



**Photo. 34** A 38 x 25 x 90 mm dropper can be alternated between posts. The advantages are flexibility and lower cost while a disadvantage is that ironbark droppers are heavy and tend to lean over. Wires are tied to droppers with high tensile wire in a 180 degree turn so as to permit lateral movement of wire. (Paragraph 112).

**109.** Aim at as few knots as possible in the wire. A figure of eight makes a good join but avoid wrapping wires around wire as much as possible. Try to avoid crossing over fences in a vehicle where there are knots as these can cause the hooking of a live wire to an earth.

### Posts and droppers

**110.** Because designs for electric fences are still in their infancy, we can expect to see many further developments over the next decade or so. There is good reason to believe that sawn ironbark posts and droppers, free of sap, in an untreated state will last for between 15 and 30 years—depending on the effect of country on the timber. In Toowoomba, half inch palings are still standing which were put in the ground 50 years ago.

**111.** At September, 1976, Hines & Sons Mill at Chinchilla and Standard Timbers' Harlaxton Mill at Toowoomba, expressed interest in supplying timber to suit the following requirements. Prices are subject to variation.



	mm	Imperial	Pointed Bored	Price Range
End Strainer .. ..	50 x 50 x 1 500	2" x 2" x 5'	P	61-79 c
Stay for strainer .. ..	50 x 50 x 1 500	2" x 2" x 5'	..	55-76 c
Running Post .. ..	50 x 25 x 1 350	2" x 1" x 4' 6"	P and B	38-39 c
Dropper .. ..	38 x 25 x 900	1 1/2" x 1" x 36"	B	18 c
Unstayed Corner Post .. ..	75 x 75 x 1 500	3" x 3" x 5'	P	\$1.60-\$1.77
Stay Pegs .. ..	100 x 25 x 400	4" x 1" x 16"	P	28 c
Bed Battens .. ..	100 x 25 x 300	4" x 1" x 12"	..	20 c

**112.** Holes in posts and droppers are 8 mm (5/16). Wires are wired on to posts and droppers with only about half a turn so that wires will still run. Both droppers and posts stand with the broad edge at right angles to the fenceline. (Photo. 34.)

**113.** The strainer is driven with a 5 degree lean against the strain which is about 100 mm (4") in a post which is .9 metres above ground level. (Photo. 22.)

**114.** A Piesse Pylola (pictured) design is excellent for putting down a crow bar sized hole as a starter for the post driving. If holes are bored, they should always be smaller than the post so that the fit is a tight one. In most conditions, posts can be driven with hand

drivers. (Photos. 25, 26, 27 and 28.) A Pylola will go down wherever an iron post could be driven.

**115.** With the strainer assembly, the stay is angled to the second top wire and fitted to the upright post by cutting out a small inverted '7'. This type of strainer assembly will stand up to 4 wires at 90 kg strain on each. If the ground is too soft to hold the strainer a stay holder can be driven down to give double the bearing surface at ground level.

**116.** Where a horizontal stay is required, the diagonal wire brace can cause a short circuit. If this brace is only one strand, it can be run through polythene for its length and so be kept insulated.

*Photo. 36 Mr. E. Bullough manages 11 properties around the 90 mile Desert area. He is shown with a Read offset light gate which gives a gateway 4 metres high at the apex and allows stock to move under for a width of about 30 metres. (Paragraphs 17, 118).*





**117.** Distances between posts and droppers will vary according to the lay of the country though 15 metre panels make a reasonable fence with alternations of running posts and droppers. Where more flexibility is required for running over the fence, 2 or 3 droppers in succession should be used. The above type of fence has a timber cost of about \$20.00 per kilometre which is less than the cost of a single strainer assembly in some conventional fences.

### Gates

**118.** A simple solution for a gate is to have a 'cocky gate'—being sure to have electrical and earth connections to the wires of the gate. (Photo. 40). All gateways should have an insulated wire (preferably galvanised) running through a length of polythene or garden hose in a 100 mm deep trench. (Photos. 7 and 22). This permits the current to flow without interruption when the gate is open. The Read Offset Lift Gate is the most common form of gate used in the south for allowing movement of stock from paddock to paddock. This is illustrated and consists of a piece of timber lying on the ground but holding the fence 3 or more metres off the existing fence line. The horizontal arm of timber is pivotted at a post which is in line with the rest of the fence. The fence is lifted through a quarter circle to the upright position. (Photos. 36 and 37).

**119.** Mr. Robert Rymill of Penola carries a slotted length of wood which is used to prop up the fence to allow stock to be moved. (Photo. 38).

**120.** In a normal fence where there is an offset electrified wire, this also should pass underground or overhead so that both sides of the fence remain alive when the gate is in the open position. A live wire can be placed parallel to a conventional gate. (Photo. 39).



*Photo. 37 Above: This offset lift gate at Exmoor Station, Naracoorte is made of hardwood. It can be lifted open or closed with finger tip pressure. The gate pivots on the post that is behind the operator. (Paragraphs 17, 118).*

*Photo. 38 Below: A low cost mobile "gate". Mr. Robert Rymill of Penola Station lifts the fence for stock to walk under. If left open, the wooden head of the lift can have a separate slot for each wire and so avoid earthing out. (Paragraphs 17, 119).*





Photo. 39 Above: A live wire across a conventional gateway prevents cattle rubbing on the gate. (Paragraph 120).

Photo. 40 Below: This cocky gate is energised by a piece of high tensile wire running through a piece of 12 mm polythene. The connection or 'switch' is held firmly in position by a wire tied lower down on the post. The tent spring prevents sagging. (Paragraph 118).



## Riding and driving over

**121.** Where motor bikes are used the front wheel of the bike is manoeuvred onto the lower end of a dropper. The fence will then lie flat under pressure and spring back to normal once the back wheel has passed over.

Vehicles used for driving over fences should be equipped with an angled bull-bar which pushes the fence over. Some vehicles have two lengths of galvanised pipe attached underneath the vehicle so that the fence wires will not catch. One vehicle used an inverted spring leaf that was attached just in front of the vehicle's rear springs and this prevented the wires from being caught underneath.

**123.** On one property, the driver put the vehicle into low gear and allowed it to keep moving while he hopped out and stood on the fence and then got back into the vehicle after it had passed over. He was feeding hay and had much less trouble than is normally the case when going through a normal gateway with hungry cattle following.

## Fences in flooded areas

**124.** The perfect answers to flood fences and flood crossings have not been found. Some floods have relatively clear and slow-moving water. In other circumstances there may be heaps of debris and big logs dragging along the ground which can ruin a crossing that lies on the ground.

**125.** It is certain that plain high tensile wire catches far less debris than other wire so it will often stand where others go over. When it does go down it is much easier to free than, say, barb or netting.

**126.** There are two possibilities for flood crossings. Droppers in the fence line can be anchored from the bottom to a solid post but tied lightly at the top so that the fence can go down under flood pressure but remain anchored. This method, however, is of restricted advantage where dragging logs are concerned. It could be best to allow for the wires to wash down but have an electrified aerial wire carrying the power across to the other side. Mr. R. L. Piesse recommends a crossing that will disconnect up on the bank when under pressure and this will avoid shorting out of the fence line.





*Photo. 41 This single wire at Ellangowan in the Condamine flood area is Mr. Glen Joppich's answer to floods. The plain high tensile wire collects debris less readily than barb and when it goes down it is easier to re-erect. Where the ground is too dry there will be a need for an earth wire. (Paragraph 28).*

**127.** In broad flat flooded areas, it could pay to have the fenceline lightly tied to posts with 16 gauge soft wire, have the fenceline securely hinged at one end of the flooded area and lightly secured at the other. If some 5 gallon drums were attached at the lightly secured end, it is feasible that the flood section could float down stream yet remain secured at the other end and offer little resistance to logs as the wire is no longer across the path of the moving obstacles.

*Photo. 42 Short panels and barb wire make repairs costly in flooded country. (Paragraph 10).*





Photo. 43 This corner post has been leant out so as to cope with the additional strain. The wires on the right are part of a laneway gate and are applying no appreciable pull. The post was driven in .9 metres and is the same length out. The black soil was moist and the post moved in about 30 mm at ground level. A stay is advised for soils that move. (Paragraph 108).

Photo. 44 This offset live wire used by Mr. P. McLennan, Yuleba has proved effective in fencing out wallabies and kangaroos for 20 kilometres around a wheat paddock. The fence was originally a 4 barb suspension type but has had the two plain earth wires added at the bottom together with the live wire. The wallaby is usually in contact with the live wire at the same time as it touches one of the earth wires. This means that the shock is received before much of the animal is through the fence. This design has proved superior to when the electrified wire is in line with all the wires. (Paragraph 128).





*Photo. 45 Strainer assembly. The horizontal stay is held in position with  $\frac{1}{4}$ " steel rod in each end of stay. Diagonal wire brace is single, run through 12 mm polythene to avoid earthing of live wire. The grace wire is tightened with 25 mm galvanised pipe with hole bored for inserting wire, rod for turning and rod for holding in position though tying of the wire should be adequate. (Paragraph 116).*

### Kangaroos and wallabies

**128.** In areas of cropping and/or improved pasture, the control of marsupials can avoid expensive losses. The natural habit of these animals is to crawl under or through rather than jump over the fences. As a live wire is often useless under dry conditions it is essential that the animal contacts both live and earth wires at the one time. This necessitates the bottom wire being an earth but close enough to the ground and with sufficient strain to force the animal to go above it so as to contact live and earth wires together. Suggested spacings from the ground up are 100, 125, 125 mm and then a further 2 wires above these to stop cattle. Mr. P. McLennan of Yuleba has had success by offsetting a live wire about 300 mm from the fence so that the contact with live and earth is made before any more than the animal's head has gone through the fence. This gives more opportunity for the animal to bounce back rather than forward when it receives the shock. Some wallabies have developed the habit of jumping about 900 mm (36") so as to avoid the live wire. (Photo. 44).

### Wild pigs

**129.** A fence on a similar principle to the marsupial fence can be used for pigs though any measure for excluding pigs should be combined with some more permanent measure such as trapping and poisoning.

### Boundary fences

**130.** It is considered that a boundary fence should not be the low type. This is mainly because uneducated cattle that do not belong to the property could run over the fence at the first contact if there were cattle attracting them from the other side. It is still a sound policy, however, to have at least one live wire in a boundary fence. This might be in the line or offset inside the fence.

### Fire risk

**131.** Considering the many thousands of high power energisers that are now used continuously in many parts of Australia, it can be concluded that the risk of fire from electric fences is very low. At least one fire has been reported as having started by the repeated arcing from a live wire to an earthed wire through a heap of inflammable weed seeds. One method of reducing the risk is to connect the high powered units at the low power terminal when the grass is very dry. Mr. McLennan of Yuleba chooses a windy day to burn a break under his suspension fences. The fences are propped up at the droppers and the grass is lit with a flame thrower. In this way, fire damage to the high tensile wire has been successfully avoided, and, when electrified, such a technique could eliminate fire risk.

### Safety

**132.** The high powered energisers put out a high powered pulse at the approximate rate of one per second. This short shock is the basis of the fence not being lethal to man or beast. Even so, care should be taken to avoid being caught in a fence, which is more likely with barb wire. Uninsulated wires at head height should be avoided as these could give a dangerous shock. The law states that the energiser must conform to the Australian Standard Specification number 129. The energisers are tested by the appropriate State authority and carry the test number issued by that authority.



133. The earth stake should be at least 2 metres away from the earth system of any other electrical installation. When electrifying boundaries, there needs to be agreement between neighbours. It is a sound idea to display a notice of electrification at the property entrances.

### Telephone lines

134. Live wires should never be carried parallel and within close proximity to a telephone line as this can cause considerable interference to the telephone. Earth circuit phone lines have bad electric fence interference when a phone line 50 metres away ran parallel to the fence for 1 500 metres.

### Costs and Comparisons

135. Because of its lightness, the recommended low electric fence with sparsely placed posts and droppers can be erected for less than quarter the cost of a conventional fence.

136. By far the most acceptable non-electric fence for cattle on the basis of low cost and effectiveness is the four barb suspension fence, but a permanent electric three wire fence can

be erected for less than half the cost of a suspension fence.

137. *Estimated cost of 1 km of three wire Electric Fence (Toowoomba prices—September, 1976).*

Only 10 km of fencing has been allowed per energiser.

	\$
3 Strainer Posts 50 x 50 x 1 500 mm @ 70 cents	2.10
3 Stays 50 x 50 x 1 500 mm @ 60 cents ..	1.80
3 Stay Pegs 100 x 25 x 400 mm @ 28 cents ..	0.84
33 Running Posts 50 x 25 x 1 350 mm @ 38 cents	12.24
33 Droppers 38 x 25 x 900 mm @ 18 cents ..	5.95
1 Corner Post 75 x 75 x 1 500 mm @ \$1.60 ..	1.60
1 Bed Batten 100 x 25 x 300 mm (for corner) @ 18 cents	0.18
2 Coils 12½ g. Flexabel Heavy Galvanised @ \$31.90 ..	63.80
8 metres of 12 mm polythene @ 29 cents per metre ..	2.32
Miscellaneous pieces of wire and garden hose	1.00
Steel post for earthing fenceline ..	1.20
9 metres of Insulation galvanised wire @ \$8 per 45 m ..	1.60
1/10 Energiser @ \$145 (10 km fence) ..	14.50
1/10 Voltmeter @ \$35 ..	3.50
Gate (cocky type) included in above	
Labour and vehicle—1 man day @ \$40 per day	40.00
	<hr/> \$152.63 <hr/>

Photo. 46 This new fence would have cost 5 to 8 times more than an electric fence. A standard suspension fence with an offset live wire makes an excellent boundary. (Paragraph 1).



138. Over 80% of the cost of this fence is made up of timber \$23.71, Wire \$63.80 and Labour \$40.00. Where 1.6 mm wire is used, the cost of wire would be \$34.58—a saving of \$29.25 but possibly substitute 25 running posts for 33 droppers. The cost of such a fence would be about \$123 per km.

139. For comparison, the approximate cost of a four barb suspension fence would be as follows.

#### *Suspension Fence—Particulars and Cost*

##### **PARTICULARS**

4 barb wires 16 gauge high tensile  
Wire spacing 250 mm (10 inches)  
Steel Waratah posts 1 680 mm (5' 6")  
Waratah droppers 960 mm (38")  
Spaces between posts 30 metres  
Strainer Posts. Diameter 150–200 mm (6"–8") and  
2 250 mm (7' 6") long, 900 mm (3') in ground  
and 1 350 mm (4' 6") out.  
Stays, 3 metres (10 ft). Diameter 100–125 mm  
(4"–5").

*Approximate cost of the 1 km of the above  
type of fence at September, 1976*

MATERIALS	\$	\$
32 steel posts 1 680 mm @ \$1.24 ..	39.68	
90 Waratah droppers @ \$36.50 per 100 .. .. .	32.76	
6 Strainer posts—2 250 mm @ \$5.25	31.50	
2 stays 3 metres @ \$5.00 each ..	10.00	
8 coils 16 g. H.T. barb @ \$20.00 per 600 m .. .. .	160.00	
		<hr/> 273.94

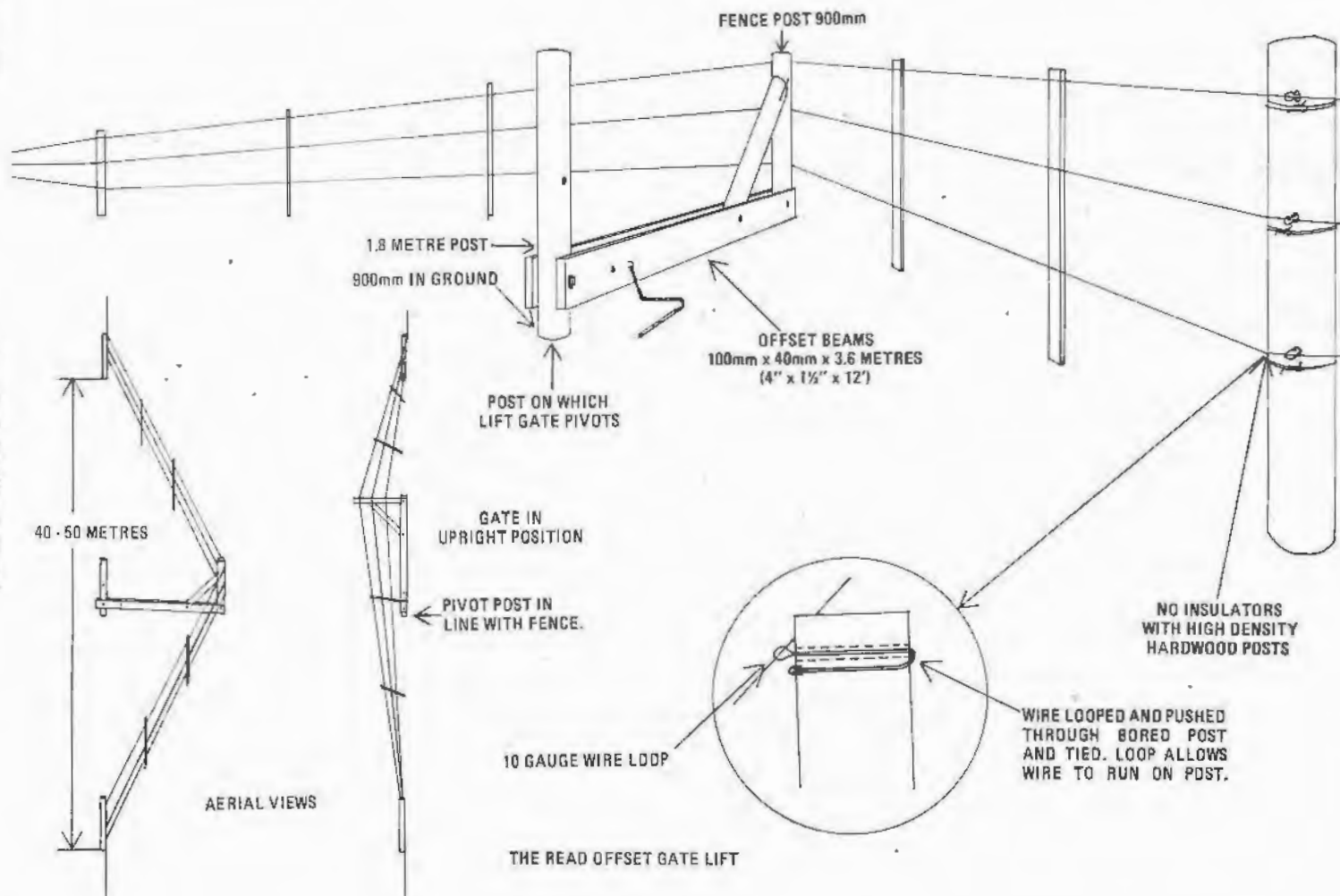
##### **LABOUR**

6 Strainers @ \$4.00 .. .. .	24.00
2 Stays @ \$4.00 .. .. .	8.00
32 Steel posts @ \$0.80 .. .. .	25.60
96 Droppers @ \$0.25 .. .. .	24.00
	<hr/>
Running and Tying included .. ..	81.60
‡ Gate and Gateway @ \$80.00 .. ..	40.00
	<hr/>
Total Cost of 1 km of Fencing .. ..	395.54

140. The cost of the three wire electric fence then is only 40% of this suspension fence.



Photo. 47 A 25 x 38 x 100 mm block of wood bored in 3 places can be tied like this. In this case a barbed wire already in the fence was untied at the posts and tied to the offset blocks. (Paragraph 7).







*Photo. 48 Above: Cows being introduced for the first time to an electric fence. One or two shocks are generally all that is required to give cattle respect for fences. (Paragraph 2).*

*Photo. 49 Upper right: This 38 x 25 x 90 mm iron-bark insulator is ideal for offsetting a wire on the "flat" side of a star post. By being offset only about 50 mm from the normal wires, the live wire is effective on cattle that are running on both sides of the fence. In this case, one of the existing wires on the fence was energised. About 60 insulators are required per kilometre for a total cost of under \$5 plus tying on.*



*Photo. 50 Lower right: This simple set-up allows faults to be readily traced. An insulated wire has been brought from the power terminal of the energiser, attached to the post, cleaned of insulation and looped at the end. Four insulated wires going to four sections of the property are hooked to the loop. When the fence is shorting out, each wire in turn is unhooked. When the wire going to the faulty section is unhooked, the energiser which has been pulsating weakly, or not at all, will re-commence normal pulsation. The wire is then re-hooked and the operator follows out along that section to locate the fault.*



#### 141. Specifications for Electric Fencing at Penola Station, South Australia

POSTS .. ..	Creosoted pine, 50-75 mm x 1.8 m.
	These do not require insulators
STRAINERS .. ..	150-200 mm x 2.4 m
POST SPACING .. ..	33.3 m (3 posts per 100 m)
WIRE .. ..	2.50 mm, 386 kg H.T. galvanised
WIRE SPACING FROM GROUND	300 mm earth 200 mm live 200 mm earth 200 mm live
STRAIN .. ..	135-165 kg
GATES .. ..	Offset arm lifts. These gates enable stock to pass under the fence and give an effective opening of about 90 m. (One post on each side of the gate is replaced with a dropper). Portable "prop gate" devices are carried on vehicles and motor cycles

#### 142. Costs per km of above fence, January 1975 Prices

		\$	\$
Posts .. ..	29 @	0.65	18.85
End Assembly .. ..	2 @	5.86	11.72
Wire .. ..	4 km @	12.16	48.64
Earth Peg .. ..	1 @	3.00	3.00
Switches .. ..	1-2 @	0.50	1.00
Insulators .. ..	4 @	0.27	1.08
Staples .. ..			1.00
*Energiser .. ..	75-125	0.00	6.25
*Testing Equipment .. ..		50.00	2.50
Gate—1 Offset Arm Lift .. ..		7.60	7.60
Labour—Approx. 10 hours .. ..		3.70	37.00
Wire Strainers .. ..	4 @	0.90	3.60
Miscellaneous .. ..		0.76	0.76
			<hr/> \$143.00

\* The cost of items marked thus is spread over 20 kms

Note:

The energiser cost has been spread over twice the distance as that for the three wire fence.

143. A high powered unit when run continuously uses approximately 10 cents worth of electricity.

#### The life of existing fences

144. It is feasible that by the use of wooden cross battens on the posts and a live wire each side of existing fences, the lives of these fences could be increased by 20 years. The cost would be approximately \$40.00 for wire and \$10.00 for battens plus energiser. Few investments could compete with such a saving.

145. In existing fences where wooden posts are used, it is possible to electrify one of the wires already in the fence.

146. Conventional and suspension fences have served our livestock industries well. They still can be expected to be used for a long time—especially as boundaries.

147. We can expect however that high costs will eventually cause a tremendous swing to some form of fence electrification.

#### Acknowledgements

The writer was sent by the Queensland Department of Primary Industries to inspect developments in this field in areas of South-eastern South Australia and Western Victoria where many properties have been involved for a number of years in electric fencing.

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In Queensland, producers such as Mr. B. McCay, Macalister, and Mr. I. McDonald, Hopelands, have been effectively using permanent electric fencing for some years, though the low light fence has not been tried to any degree.

## APPENDIX

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	Acknowledgements